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PROGRAM

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Misinchinka Ranges Winter Ungulate Inventory, March 1996

P. E. Hengeveld and M. D. Wood
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**Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave.
3rd Floor, Prince George B.C. V2L 3H9**

Website: www.bchydro.bc.ca/environment/initiatives/pwcp/

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Author(s): Pamela E. Hengeveld¹ and Mari D. Wood¹
Address(es): ¹ Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor
Prince George, B.C. V2L 3H9

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1.0 INTRODUCTION

The Peace/Williston Fish and Wildlife Compensation Program (PFWWCP) has conducted many winter inventories of high-elevation mountain ranges throughout the Williston Reservoir watershed in north-central British Columbia. The inventory objectives have been to obtain population and distribution data on woodland caribou (*Rangifer tarandus caribou*), Stone's sheep (*Ovis dalli stonei*), and mountain goats (*Oreamnos americanus*). Information on the distribution and abundance of woodland caribou in the Williston Reservoir watershed was fragmentary up until the mid-1990's. Recent studies and inventories have identified the distribution and numbers of several herds and/or winter ranges throughout the watershed (Murray 1992; Wood 1994, 1995a,b, 1996, 1998; Wood and Hengeveld 1998b; Backmeyer and Wood, in prep.).

The Williston Reservoir watershed supports about 10% (1100) of the world's Stone's sheep, including about 160 animals in the Peace Arm region (Davidson and Dawson 1990). The majority of these sheep are found on the north side of the Peace Arm, between Butler Ridge and the Nabesche River (Davidson and Dawson 1990). Only a few sheep exist south of the Peace Arm. In the late 1970's, roughly 20 sheep were observed at Mt. Selwyn (J. Elliott, BC Environment, Fort St. John, personal communication); reports of approximately 15 sheep were noted in the 1980's (D. King, BC Environment, Prince George, personal communication). During a 1991 inventory of wildlife wintering on mountain ranges south of the Peace Arm, only 11 Stone's sheep were located: 7 on Mt. Selwyn and 4 further east on Mt. Monteith (Backmeyer 1991), the latter of which were transplanted to the area one year earlier by the PFWWCP.

There are an estimated 2000 mountain goats distributed throughout the Williston Reservoir watershed (Davidson and Dawson 1990). Most goats residing in the Peace Arm region winter on south or west-facing wind blown slopes on steep, rocky terrain. Backmeyer (1991) located 30 goats in 12 groups between Mt. Crysedale and Carbon Creek during a 1991 winter inventory south of the Peace Arm. Only 2 of the 30 goats were observed west of Clearwater Creek, despite an apparent abundance of suitable goat habitat in the northern Misinchinka Ranges (Backmeyer 1991). It is not known whether predation and disease are limiting factors for goat populations adjacent to the Peace Arm, however, increasing human development (particularly resource extraction) facilitates hunter access to high-elevation ranges in this region (Davidson and Dawson 1990).

The Misinchinka Ranges in the Rocky Mountains north of Mackenzie, BC, may contain important ungulate habitats. Careful long-term planning and management is crucial to the well-being of these species. Wildlife concerns in these mountain ranges include potential forest harvesting and increased road access, recreational development, and snowmobile activity. Woodland caribou, Stone's sheep, and mountain goats are sensitive to human presence (Davidson and Dawson 1990); human activities and development can displace animals, impact forage availability and habitat selection, disrupt migration routes, facilitate predation, and result in increased legal and illegal hunting.

To assist with land use planning processes in this area, an assessment of winter ungulate distribution and habitat use within the Misinchinka Ranges was conducted on 24 and 25 March 1996. The primary objectives of this inventory were to locate ungulates wintering in alpine and subalpine habitats on the Misinchinka Ranges between Colbourne Creek and the Peace Arm of the Williston Reservoir, and to identify species, distribution, group size, and age/sex ratios for animals observed. A secondary objective was to identify areas where intensive human activities may conflict with important ungulate wintering habitat. This report documents the results of the 1996 Misinchinka Ranges inventory.

2.0 SURVEY AREA AND WEATHER CONDITIONS

The survey area lies within the Misinchinka Ranges and Hart Ranges ecosections in the Central Canadian Rocky Mountains ecoregion, and extends from the Peace Arm of the Williston Reservoir south to Colbourne Creek (a tributary of the Parsnip River), and west to Clearwater, Link and Mountain Creeks (Figure 1). The Misinchinka Ranges include the height of land of the Rocky Mountains, and are characterized by steep rugged terrain and deep snow accumulations (Davidson and Dawson 1990). The survey area included all of the alpine and subalpine parkland, and some of the upper elevation forests in the Engelmann Spruce-Subalpine Fir (ESSF) biogeoclimatic zone. The gentler terrain of the Rocky Mountain foothills east of the Misinchinka Ranges was also surveyed in 1996 (Wood and Hengeveld 1998a,b).

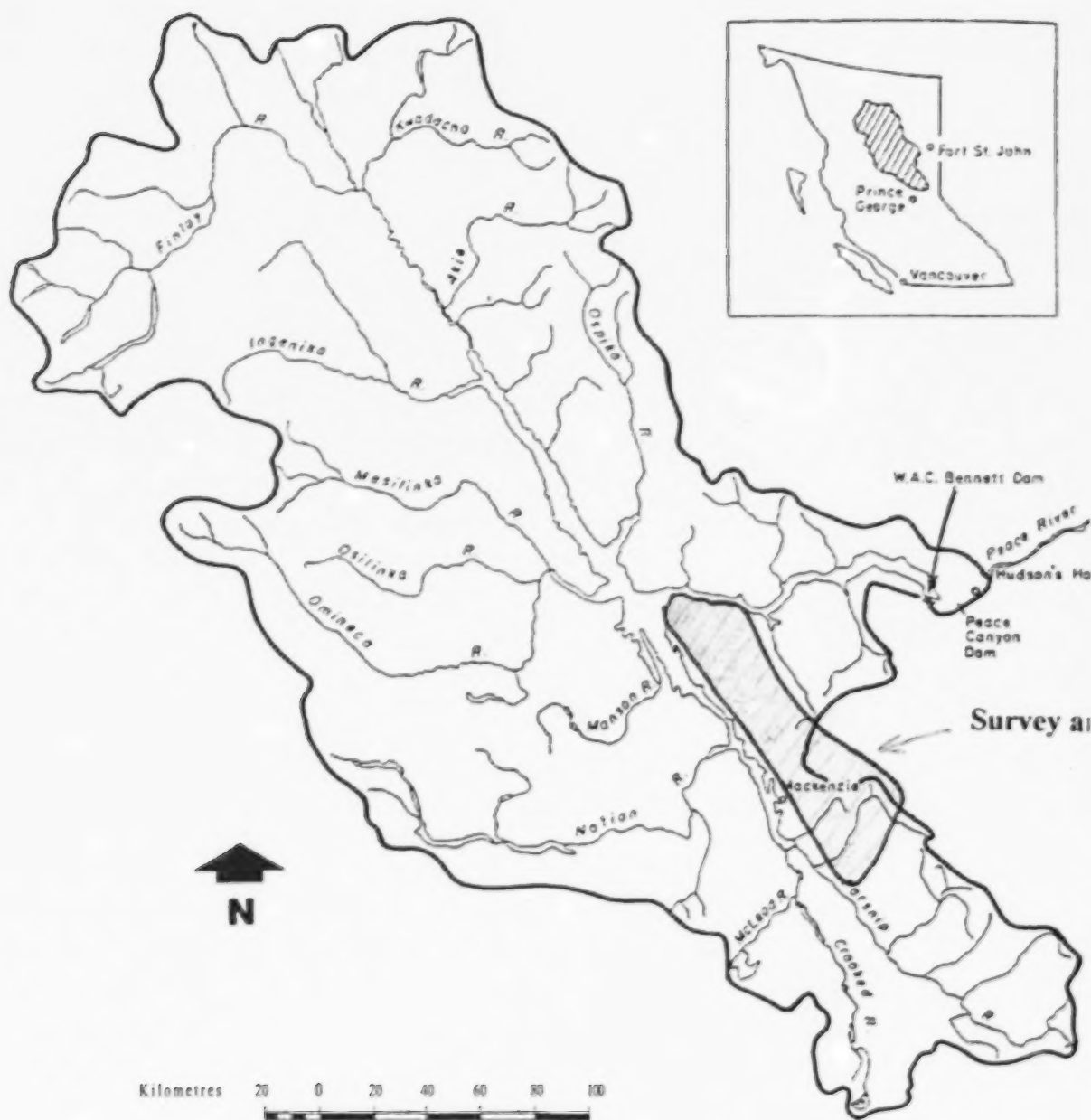


Figure 1. Misinchinka Ranges survey area within the Williston Reservoir watershed.

24 March 1996 was clear and cool with light to moderate winds. Air temperature was -10°C at the Mackenzie Airport (1000 hrs). On 25 March, winds were from the south at 20 knots, air temperature was -8°C at Mackenzie Airport (0900 hrs), and high elevation cloud cover was approximately 60-70%. The region surveyed was estimated to be 95-100% snow covered, with depths greater than 3m in the subalpine. There were very few windswept ridges in the survey area, and these were separated by heavily snow-covered ridges. The snow had a crusted layer which appeared to facilitate caribou movement. More than four days had elapsed since the last snowfall.

3.0 SURVEY METHODS

The survey was conducted with a Bell 206 helicopter chartered from Northern Mountain Helicopters (Prince George). Total survey time was 7.3 hrs on 24 March and 8.0 hrs on 25 March, including ferry time to and from the survey area and refuelling stops. The survey began at Mt. Selwyn near the mouth of the Peace Arm, and worked southwards, roughly following elevational contour lines around each mountain block (see Appendix A for survey flight line). In most cases, the flight path taken was mid-way between treeline and height of land. In areas where this distance was too large to be effectively surveyed in one sweep, transects were flown across the slope at varying contour intervals. Alpine areas and the treeline were searched for ungulate groups and/or tracks. Fresh tracks leading to or from forested areas were followed into the trees in an attempt to locate ungulate groups or signs of habitat use. Some unlikely habitats (i.e., very steep terrain with deep snow and highly snow-covered ridges) were not extensively searched.

The three-person crew on 24 March included PFWWCP wildlife biologists Mari Wood and Fraser Corbould, and BC Environment Senior Habitat Protection Officer Jim Tuck. Randy Zemlak, PFWWCP fisheries technician, assisted Wood and Corbould on 25 March. M. Wood searched for, counted and classified animals, and recorded the flightline and animal locations on 1:250,000 topographic maps. The two rear seat observers also searched for and classified animals; F. Corbould recorded all observations on survey forms, and J. Tuck/R. Zemlak recorded position coordinates for each group of caribou located using the helicopter's on-board Global Positioning System (GPS) unit. Where multiple groups of caribou were located within close proximity (eg. 100-300 m apart), only one GPS location for the groups was obtained. Woodland caribou were classified as male or female, and as adults or calves. Male caribou were distinguished from females based on the absence of the black vulvar patch. Stone's sheep were classified as adult rams (class

II-IV), adult ewes, yearlings, or lambs based on horn development (Geist 1971). Mountain goats were similarly classed as adult male, adult female, yearling, or kid (Smith 1988). If sex or age could not be determined the animal was recorded as 'unclassified'.

4.0 RESULTS AND DISCUSSION

Woodland caribou, Stone's sheep and mountain goats were all observed at the extreme north end of the survey area, near Mt. Selwyn and Mt. Crysdale (Figure 2). Caribou were also located in the southern part of the survey area, between Mt. Morfee and Old Friend Mountain (Figure 3). No ungulates were located between Mt. Crysdale and Mt. Morfee, and only a few caribou tracks were noted here. Universal Transverse Mercator (UTM) co-ordinate locations for each animal group observed are listed in Appendix B.

4.1 Woodland caribou

At the north end of the Misinchinka Ranges, 17 caribou in 5 groups were observed (mean elevation of groups: 1550 ± 187 m SD); 43 caribou in 10 groups were located in the southern part of the survey area (mean elevation of groups: 1445 ± 83 m SD). All but 2 (on Mt. Crysdale) of the 60 caribou observed during the survey were found in the subalpine or upper elevations of the ESSF zone (Table 1).

The northern portion of the survey area (around Mt. Selwyn and Mt. Crysdale) is steep and rugged, with little parkland habitat or gentle, rounded terrain. Deep snow was prevalent in this area; a snowpit dug in a subalpine meadow (1500 m elevation) south of Point Creek was over 3 m deep. Windswept alpine areas were slightly more prevalent in the south (e.g., Mt. Morfee). Caribou and caribou tracks seen on Mt. Morfee and the adjacent unnamed mountain to the south were all in the lower subalpine-upper ESSF zone. The steep, rocky, southwest-facing slopes on the Murray Range exhibited some windswept areas, however, the caribou groups and extensive caribou tracks observed were all on the northeastern side of the range, in the subalpine/ESSF. Overall, very few tracks were seen during the survey, but signs of caribou use were particularly sparse in the mountains between Mt. Crysdale and Mt. Morfee.

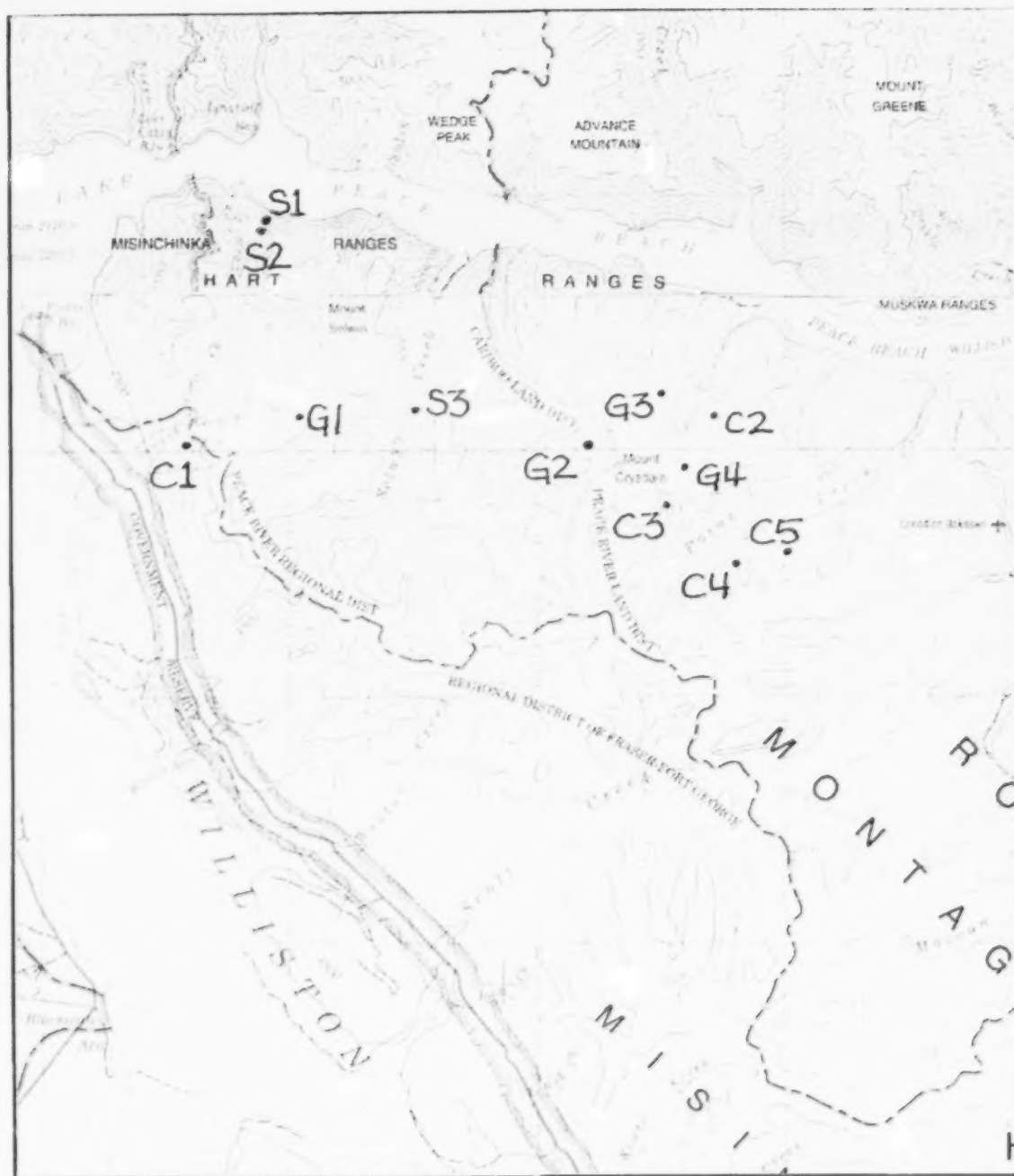


Figure 2. Map locations of ungulate groups observed in the northern Misinchinka Ranges, March 1996 (scale 1:250,000). [C=caribou, G=mountain goat, S=Stone's sheep; number refers to group number, not the number of individuals observed].

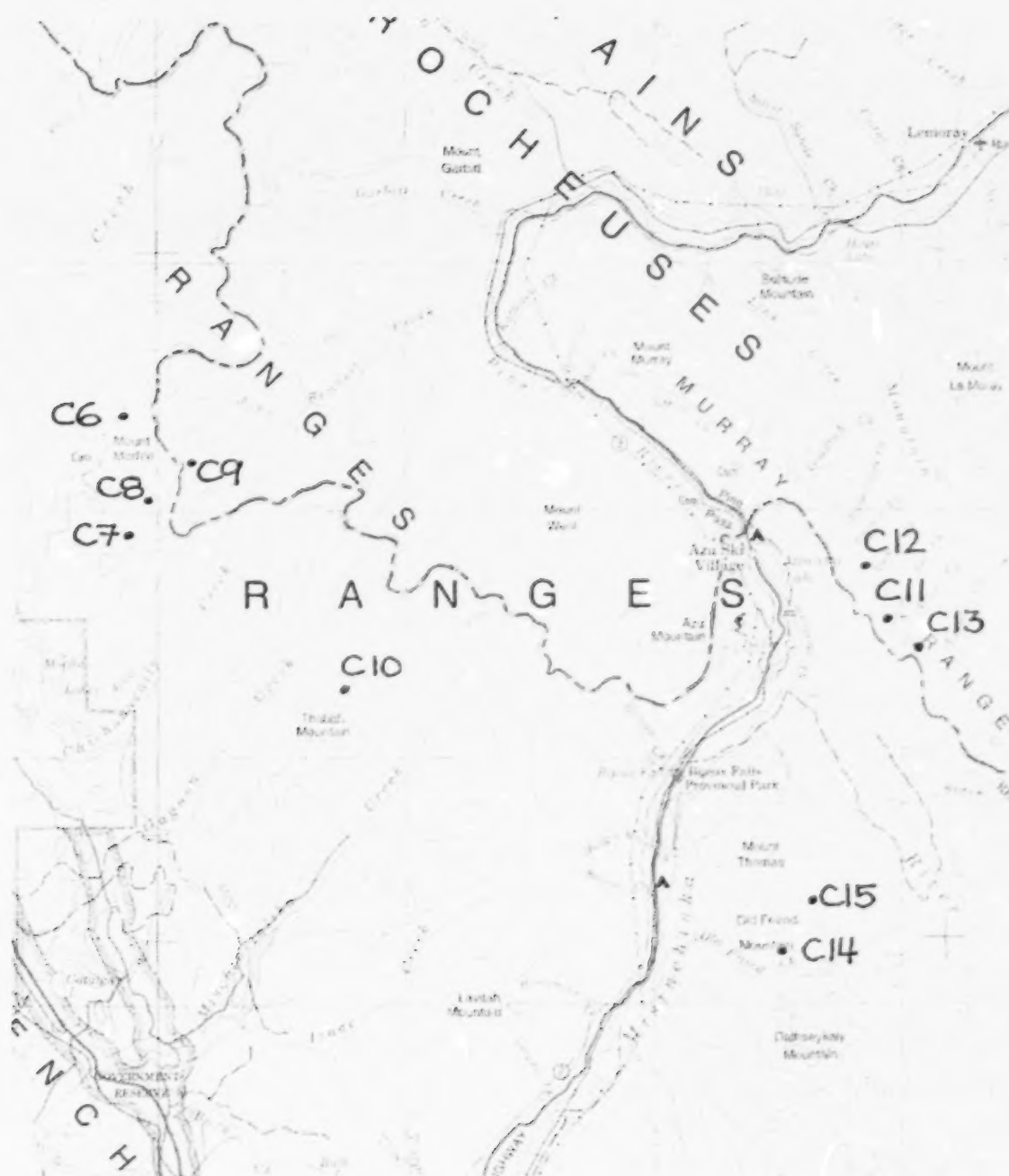


Figure 3. Map locations of ungulate groups observed in the southern Misinchinka Ranges, March 1996 (scale 1:250,000). [C=caribou, G=mountain goat, S=Stone's sheep; number refers to group number, not the number of individuals observed].

Table 1. Locations and age/sex composition of woodland caribou groups observed on Misinchinka Ranges, 24-25 March 1996.

	Map locations	Elev, (m)	Habitat	Adult			Calf			Total
				M	F	UC	M	F	UC	
C1	Mt. Selwyn	1500	edge of timber, using subalpine (ESSF); only windswept ridge in area is above caribou location		1			1		2
C2	Mt. Crysdale	1800	alpine; lots of cratering	1	1					2
C3	Mt. Crysdale	1650	bottom of draw (ESSF), some tracks in alpine	1	4					5
C4	S of Point Crk.	1500	in timber near alpine (ESSF)	3						3
C5	S of Point Crk.	1300	timber (ESSF)			4			1	5
C6	Mt. Morfee	1350	subalpine (ESSF)		1				1	2
C7	Ridge S of Morfee	1450	subalpine, some tree cover; bedded down near alpine	2						2
C8	Ridge S of Morfee	1400	subalpine (ESSF), firm snow	2	5		1			8
C9	Ridge S of Morfee	1500	subalpine (ESSF), lots of tracks	1	1	1	1			4
C10	Thabah Mtn.	1450	avalanche chute (ESSF)	6						6
C11	Murray Range	1450	parkland (ESSF)	1	1		1			3
C12	Murray Range	1300	parkland (ESSF)	2	1					3
C13	Murray Range	1450	parkland (ESSF)	3	5					8
C14	Old Friend Mtn.	1600	subalpine (ESSF)	1						1
C15	Old Friend Mtn.	1500	small meadows (ESSF)	3	3					6
TOTAL				26	23	5	3	1	2	60

4.1.1 Population Composition

The sex and age composition of the 60 caribou observed was skewed towards adults, with only 6 calves observed (Table 2). The winter calf/cow ratio for caribou observed on this survey was 26 calves per 100 cows; the proportion of calves among all caribou observed was 10% (n=60). The proportion of calves observed in other caribou populations within the Williston Reservoir watershed in the 1990's ranged between 10% and 17%, with the lowest proportions observed in 1996: 10% in the Wolverine Herd (Wood 1998) and 9% in the Upper Moberly River/McAllister Creek drainages south of the Peace Arm (Wood and Hengeveld 1998b). Fall calf recruitment ranged between 10% and 13% for 4 caribou herds in northern BC between 1976 and 1983 (Bergerud and Elliott 1986). Woodland caribou herds are thought to increase when the recruitment

of yearlings into the population exceeds 12-15% (Bergerud 1988), while populations with recruitment <10-12% show little change (Bergerud 1974, Bergerud and Elliott 1986).

Table 2. Sex and age composition of caribou observed during 24/25 March 1996 survey.

Bulls	Cows	Calves	Bulls/ 100 Cows	Proportion of bulls in adult population	Calves/ 100 Cows	Calves/ 100 Adults	Proportion of calves in population
26	23	6	113:100	48%	26:100	11:100	10%

Caribou groups observed in the Misinchinka Ranges showed an abnormally high bull/cow ratio of 113 bulls: 100 cows. The mean bull/cow ratio of 10 herds examined throughout northern BC in the 1970's ranged from 35 to 50 bulls per 100 cows (Bergerud 1980). The proportion of males observed in the adult population during the Misinchinka survey was 48%; Bergerud (1980) reported a mean of 36% for 22 caribou populations throughout North America. Adult sex ratios in North American caribou are usually weighted to females, due primarily to the differential mortality of males and the greater longevity of females (Bergerud 1980). A low number of males in a population may result from heavy predation, hunting pressure, winter starvation (i.e., males enter the winter in poorer physical condition than females), and/or chronic poor recruitment (Bergerud, 1980). If calf recruitment is good and the population has a younger age structure, the resulting greater number of young males in the population will increase the ratio of males to females (Bergerud 1980). For 4 herds in BC with calf recruitment >10%, the adult sex ratio was 49 bulls per 100 cows, while six herds with calf recruitment <10% showed bull/cow ratios of 33:100 (Bergerud 1978a). This relationship between high adult mortality and low calf survival, is suggested to result from increased predation (Bergerud 1978a).

In this case, low calf recruitment was combined with a very high proportion of bulls, suggesting the possibility that some cow/calf groups may have been missed on the survey. Overall, relatively few caribou were located on the survey, and the unusual age/sex ratios observed might be explained by one or both of the following: a) caribou wintering in this area are on the periphery of the main winter range of this herd, or b) caribou, particularly cows and calves, were selecting primarily ESSF habitat and were thus not seen during the survey.

The low number of cows and calves observed on this survey may indicate that a part of this caribou population winters outside of the surveyed area. Spatial segregation of the sexes on winter ranges has been observed in many woodland caribou herds (R. Farnell, Yukon Government Renewable Resources Dept., personal communication). Counts of the Finlayson and other Yukon woodland caribou herds during the rut, when caribou age and sex classes are intermixed, resulted in higher proportions of bulls observed than on late winter range surveys, when caribou were found to be spatially segregated (Yukon Renewable Resources Branch, Whitehorse, YK, unpublished data). Caribou surveys have also been conducted in the foothills of the Rocky Mountains (Moberly River/McAllister Creek area), approximately 50 km east of the Misinchinka Ranges survey area (Wood 1995a,b; Wood and Hengeveld 1998b). The survey conducted in March 1996 located 181 caribou and recorded a bull:cow ratio of 56:100 (Wood and Hengeveld 1998b); this was lower than the March 1995 survey ratio of 86 bulls: 100 cows (Wood 1995b). The Moberly/McAllister and Misinchinka caribou may potentially belong to the same population. Caribou observed in the Misinchinka Ranges may be individuals which remained on summer/calving ranges in rugged mountainous terrain, rather than migrating to the milder foothills region of the Rocky Mountains. However, low calf proportions and slightly above normal bull/cow ratios were also observed on the March 1996 Moberly/McAllister survey (Wood and Hengeveld 1998b).

4.1.2 Typical Group Size

Typical group size (TGS) is the size of group in which the average animal finds itself, and is a more accurate measure of the behaviour of individuals than is the frequency of groups as measured by the mean (Jarman 1974). TGS was calculated according to the methods described in Jarman (1974). The TGS of caribou observed during the survey was relatively small for late winter, only 5.2 animals ($n=60$; 15 groups). TGS's observed during two other 1996 late winter caribou surveys in the Williston Reservoir watershed were similarly small: 7.1 animals ($n=204$; 42 groups) in the Wolverine Ranges, and 7.4 animals ($n=181$; 32 groups) in the Moberly/McAllister area (Wood 1998, Wood and Hengeveld 1998b, respectively).

4.1.3 Habitat Use

The Misinchinka Ranges lie in a deep-snow belt, while milder winter conditions exist in the Rocky Mountain foothills to the east, where warm Chinook winds often reduce snow accumulations. Backmeyer (1991) reported that 82% of caribou observed east of Carbon Creek in February 1991 were using alpine habitat almost exclusively, and that caribou use of the alpine decreased drastically

as snow depth increased west of Carbon Creek; in the latter, all caribou and caribou track sites observed were associated with subalpine forest habitats. Almost all caribou observed during this survey were located in upper ESSF/subalpine habitats. The predominant use of subalpine/ESSF habitat by caribou, even in areas where some apparently suitable windswept alpine habitat was nearby (e.g., Mt. Morfee), is inconsistent with other late winter caribou surveys conducted throughout the Williston Reservoir watershed. During average snowfall years, caribou observed on surveys of the Chase Herd (1993), Wolverine Herd (1989, 1993, 1996), and Muskwa Mountain Ranges (1994) were located primarily in the alpine or, to a lesser extent, the subalpine (Hatler 1989; Wood 1993; Corbould 1993; Wood 1994, 1998). Hatler's February 1989 survey of the Wolverine Range was restricted to alpine areas, but he reported distinct trails leading to and from forested habitat and suggested that some caribou may have been present below timberline and thus not located (Hatler 1989). Caribou observed during 1995 and 1996 surveys in the Moberly River/McAllister Creek area east of the Misinchinka Ranges were also on windswept alpine slopes, with the exception of some caribou located in the subalpine/ESSF on Boulder Ridge in 1996, where alpine slopes were heavily snow-covered with no windswept ridges (Wood and Hengeveld 1998b).

There are two ecotypes of woodland caribou in BC: 'mountain' and 'northern' (Stevenson 1991). Mountain caribou reside in the Rocky Mountains in the east-central and south-eastern portions of the province. The break between the Rocky Mountains and the more easterly Rocky Mountain Foothills forms the boundary between the mountain and northern ecotypes in this part of the province (Stevenson and Hatler 1985). Mountain caribou forage primarily on arboreal lichens in winter; as snowpack increases to depths greater than 2 m, lichen hanging on the lower branches of standing trees become an available food resource (Stevenson 1991). Winter range for the mountain ecotype is typically open-canopied mature stands on high subalpine plateaux (Stevenson 1991). Caribou in the western and northern parts of B.C. are northern ecotype caribou, which forage primarily on terrestrial lichens in winter. This generally restricts their winter range to areas with low snow accumulation, including low elevation lodgepole pine (*Pinus contorta*) or pine/spruce (*Picea spp.*) stands, and windswept alpine slopes (Wood 1996). During winters of low snowfall, many northern caribou remain in low elevation forested habitats, whereas heavy snows force caribou up to higher elevations to winter on windswept alpine slopes. Snow depths in 1996 were noted to be higher than normal in all areas surveyed within the Williston Reservoir watershed (Ministry of Environment, Lands and Parks 1996), and likely influenced the habitat selection and distribution of wintering caribou.

Most caribou herds in the Williston Reservoir watershed belong to the northern ecotype, however, the exclusive use of forested ESSF habitat by caribou observed during this survey is more indicative of mountain caribou behaviour. Caribou wintering in the Misinchinka Ranges - at least as far north as Mt. Morfee - are likely of the mountain ecotype, thus extending the previously reported range of mountain caribou in BC from just north of Prince George (Bergerud 1978b, Stevenson *et al.* 1994, Terry *et al.* 1996, Simpson *et al.* 1997) to just north of Mackenzie.

4.2 Stone's Sheep and Mountain Goats

Eight sheep in 3 groups and 6 mountain goats in 4 groups were observed on the survey (Tables 3 and 4). All animals were found on Mt. Selwyn or Mt. Crysdale, at the extreme north end of the survey area (Figures 2 and 3). This area is predominantly steep and rugged with extensive cliff habitat. Forage availability appears to be limited, and access to these areas may be restricted by deep snow. Murray Ridge, in the southern portion of the survey area, has many southwest-facing slopes with some steep terrain and scree slopes; no sheep or goats were observed here.

Table 3. Locations and classifications of Stone's sheep groups observed.

Map location	Elev. (m)	Adult		Yrlg	Lamb	Total
		M	F			
S1 Mt. Selwyn	1300	1 [†]		1		2
S2 Mt. Selwyn	1450		2			2
S3 Mt. Selwyn	1700		2	1	1	4
TOTAL		1	4	2	1	8

[†] Class II ram.

Table 4. Locations and classifications of mountain goat groups observed.

Map location	Elev. (m)	Adult			Yrlg	Kid	Total
		M	F	UC			
G1 Mt. Selwyn	1900	1					1
G2 Mt. Crysdale	1900				1		1
G3 Mt. Crysdale	2050		1	1		1	3
G4 Mt. Crysdale	2100	1					1
TOTAL		2	1	1	1	1	6

It appears that Stone's sheep numbers south of the Peace Arm of the Williston Reservoir may have declined over the last two decades. The Williston Reservoir reached full pool by 1972, subsequent to construction of the W.A.C. Bennett dam in 1969; creation of the reservoir may have isolated sheep south of the Peace Arm from other sheep to the north. Only 8 sheep were observed during the March 1996 survey of the Mt. Frank Roy/Mt. Monteith area east of the Misinchinka Ranges, despite a series of sheep transplants to this area in the early 1990's (Wood and Hengeveld 1998a).

Backmeyer (1991) reported an apparent abundance of suitable goat habitat south of the Peace Arm and noted that goats observed east of Clearwater Creek during a 1991 ungulate inventory were using habitat similar to that found in the Misinchinka Ranges.

4.3 Other Wildlife Observed

Incidental sightings of 11 golden eagles (*Aquila chrysaetos*) in flight were recorded during the survey: 1 at Mt. Selwyn, 6 at Mt. Crysedale, 1 at Clearwater Creek, 2 at the headwaters of Cut Thumb Creek, and 1 at the Murray Range. UTM coordinates for each location are listed in Appendix B. The Rocky Mountains are a major migration route for golden eagles heading north in the spring (Sherrington 1993).

Two moose (*Alces alces*) were observed on a small knob at the extreme northwest end of Mt. Selwyn, just below the Stone's sheep groups S1 and S2. A wolverine (*Gulo gulo*) was sighted on an alpine ridgetop at the headwaters of Macoun Creek (between Mt. Crysedale and Mt. Morfee).

5.0 POTENTIAL LAND USE CONFLICTS

5.1 Northern Portion of the Survey Area (Mt. Selwyn to Mt. Crysedale)

In the immediate vicinity of Mt. Selwyn and Mt. Crysedale, few conflicts are likely to arise between wildlife and other land use activities given the steep, inaccessible terrain in this area. However, some potential conflicts may exist with forest harvesting at mid and lower elevations: sheep and goats may use mid-elevation timbered bluffs in winter, while caribou may use lower elevation forests along the Williston Reservoir to the west, and Clearwater Creek to the east. No data currently exist on ungulate use of these potential winter habitats. The presence and location of

mineral licks have also not been documented for this area. Winter recreational pursuits such as snowmobiling or skiing are likely non-existent at higher elevations due to the rugged terrain.

5.2 Central Portion of the Survey Area (Mt. Crysedale to Mt. Morfee)

Based primarily on the lack of ungulate numbers and sign observed between Mt. Crysedale and Mt. Morfee, it appears that few conflicts between wintering ungulates and other land use activities would exist in this area. The results of this survey indicate that the central portion of the Misinchinka Ranges survey area may be more amenable to potential forest harvesting activities (i.e., incurring the least impact on wintering ungulates) than the northern or southern portions. Winter recreational activities such as snowmobiling or heli-skiing could possibly also be encouraged in this area. However, the use of forested habitats by wintering ungulates, particularly caribou, should be more thoroughly examined prior to making any such recommendations. 1996 was a deep snow year thus, despite their apparent absence from this area during the survey, caribou may be present here in other years.

5.3 Southern Portion of the Survey Area (Mt. Morfee to Old Friend Mtn)

This area has the greatest potential for conflicts between the maintenance of caribou populations and other land use activities. Caribou observed during this survey were wintering in forested habitats in the upper elevation ESSF zone, exhibiting behaviour typical of the arboreal lichen-feeding mountain caribou ecotype. Harvesting of the major drainages, including the associated access roads, could negatively impact this caribou winter range. In addition, the extent to which low elevation forests in this area are used by caribou in winter is unknown, thus the degree to which caribou would be affected by forest harvesting at lower elevations is unknown.

Snowmobile activity was prevalent in the mountains around Mackenzie and may potentially be displacing caribou wintering in this area. Snowmobile tracks were extensive on Mt. Morfee and the adjacent unnamed mountain to the south. Caribou and caribou tracks were also seen on both mountains, but always in the subalpine/ESSF. It is unlikely that caribou are being displaced from alpine habitats by snowmobile activities this winter, as there is a lack of windswept slopes in the alpine for caribou to access forage. However, the extent of snowmobile activity in the upper elevation forest and meadows may be harassing caribou, thereby causing additional stress on the animals and displacing them into less favourable forested habitats. Caribou do not tolerate high levels of snowmobile use, but can be habituated to low levels under proper management regimes

(Simpson 1987). Snowmobiling should either be encouraged in areas absent of wintering caribou, such as the area between Mt. Crysdale and Mt. Morfee, or limited primarily to alpine areas with specified access and travel routes between sites.

6.0 RECOMMENDATIONS

6.1 Caribou

Additional inventories of the Misinchinka Ranges should be conducted with a greater emphasis on searching the upper ESSF/subalpine zone, to confirm the presence or absence of caribou in the upper elevation forested habitats of this survey area. Surveys should be completed in conjunction with inventories of the adjacent mountain ranges (i.e., the Mt. Frank Roy - Moberly River/McAllister Creek area), to confirm or deny the theory that cow/calf groups may be spatially segregated from other caribou during the winter.

A radio-telemetry study should also be considered. Such a study would help determine the extent of this population's winter range, and the seasonal distribution, movements, and habitat use of these caribou. Ideally, caribou should be radio-collared from both the Misinchinka Ranges and the Moberly River/McAllister Creek area in the Rocky Mountain foothills to the east, where winter range appears to be more favourable. Radio-collaring animals from both areas may provide an indication of how caribou wintering in the Misinchinka Ranges interact (if at all) with caribou wintering in the foothills east of Clearwater Creek.

6.2 Stone's Sheep and Mountain Goats

Comprehensive surveys of Stone's sheep and mountain goats at the northern end of the Misinchinka Ranges would enable a better assessment of population size, dynamics, and habitat use of these species. During winter inventories, all mid-elevation timbered bluffs should be searched in addition to typical alpine and subalpine ranges. Summer inventories for mountain goats should also be conducted. In mid-summer, goats typically use higher elevations, are easier to sight in the absence of snow, and are most easily classified (RIC 1996). Areas of extensive cliff terrain should be scanned using binoculars and spotting scopes from ground vantage points, thereby reducing the chance of missing animals.

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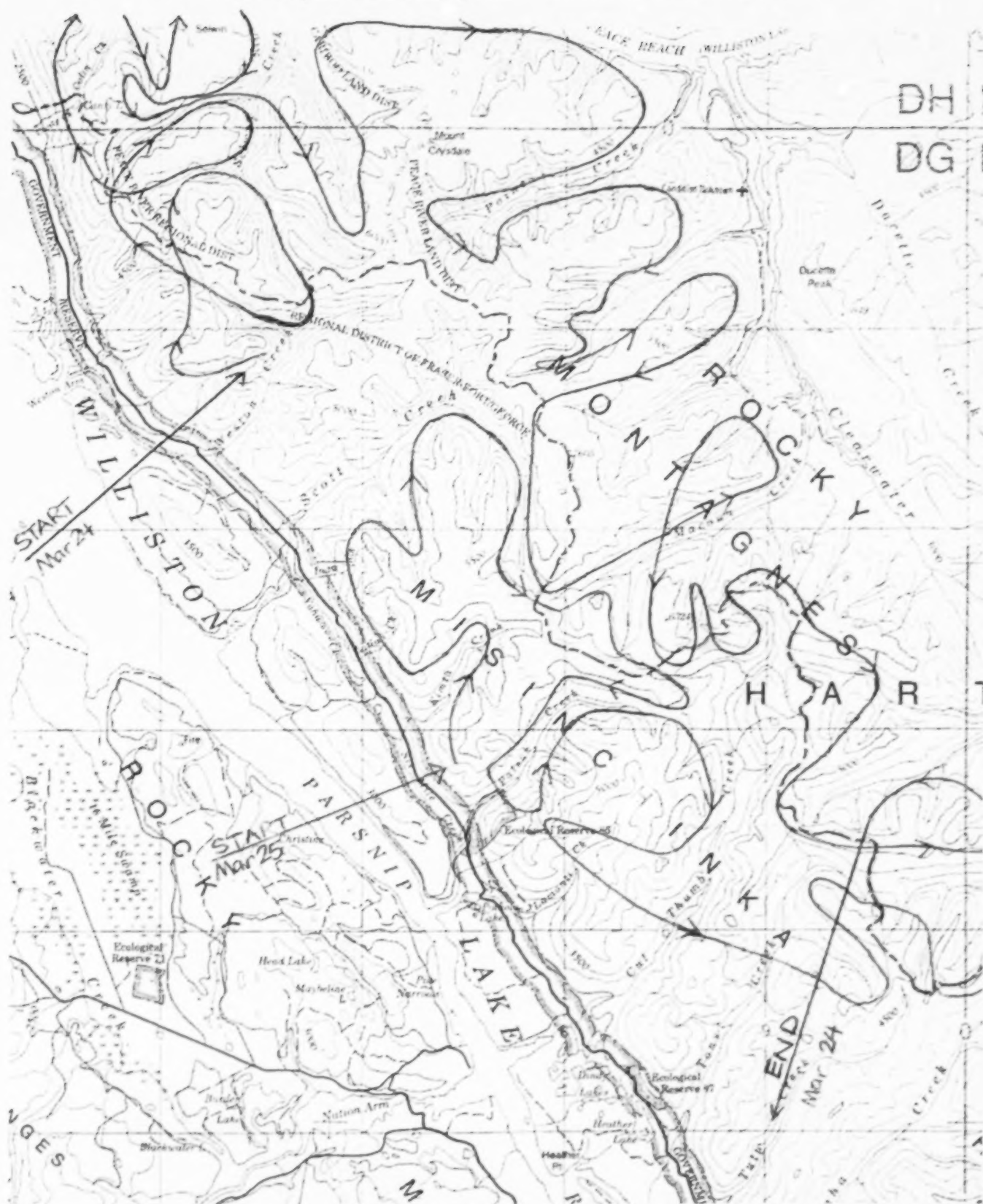
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APPENDIX A

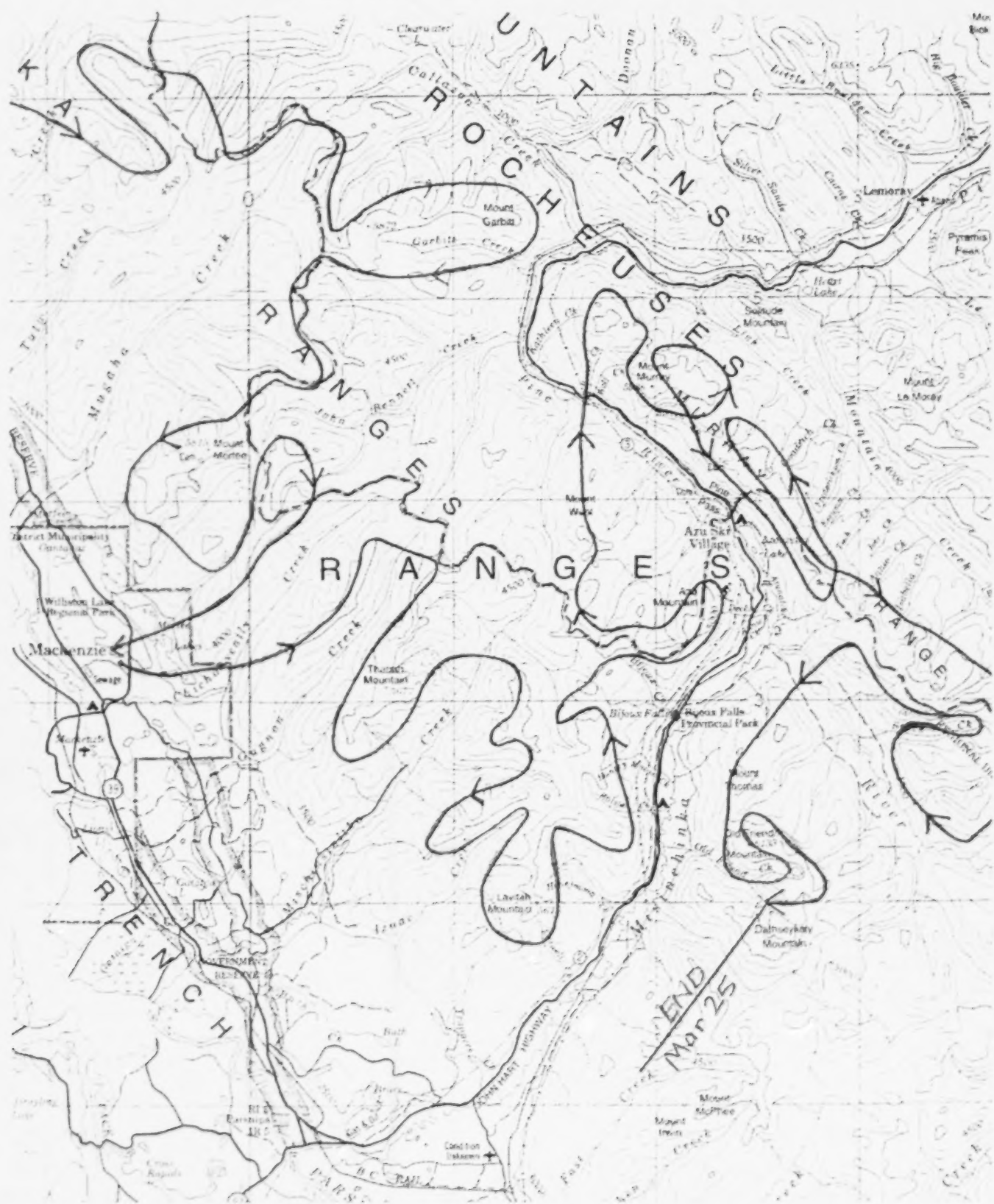
Survey route for the 1996 Misinchinka Ranges ungulate inventory.

1. Northern portion of the survey area
2. Southern portion of the survey area

1. Northern portion of the survey area. (Scale 1:250,000)



2. Southern portion of survey area. (Scale 1:250,000)



APPENDIX B

UTM locations for wildlife observed during the 1996 Misinchinka Ranges inventory.

C=woodland caribou, S=Stone's sheep, G=mountain goat, E=golden eagle.

Group	Easting	Northing
C1	455595	6200362
C2	477210	6201317
C3	475109	6197804
C4	478013	6195377
C5	480099	6195923
C6	498840	6143942
C7	499683	6139119
C8	499367	6140417
C9	502321	6141902
C10	507506	6132634
C11	529475	6135508
C12	528614	6137913
C13	530749	6134589
C14	525007	6122126
C15	526373	6124174
S1	459384	6209054
S2	459174	6208870
S3	461499	6201614
G1	460559	6201251
G2	472104	6200234
G3	475030	6202256
G4	475950	6199283
E1	454339	6203539
E2	478864	6198897
E3	474697	6198548
E4	475314	6197246
E5	473650	6197627
E6	489637	6202256
E7	n/a	n/a
E8	n/a	n/a
E9	527364	6135123

